CATALOGUE OF VARIABLE STARS SOUTH OF −30° DECLINATION.

By A. W. Roberts.

[Read 30th March, 1892.]

The following is a list of variable stars south of −30° Dec. with the latest observations concerning most of them.

The first southern variable discovered was η Argus by Burchell in 1811.

In 1866 Prof. Schmidt, Athens, among other similar discoveries in the Northern Hemisphere found two variables, both below the 10′ mag. in the Southern Crown, and in 1867 Mr. Ragoonetha Chary, a Hindu assistant at the Madras Observatory, discovered another variable in Reticulum.

Until the year 1872 *four stars* only were known to be variable in that portion of the sky invisible to Northern observers.

In 1872 Dr. Gould took charge of the Argentine Observatory at Cordova and during the next six years discovered no less than thirty-five variable stars, twenty-five of which lie within the zone dealt with in this catalogue.

In 1891 and 1892 six short period variables and four probably long period variables were added to those already known.

These new variables are Nos. 3, 5, 11, 15, 20, 24, 25, 26, 28, and 34.

The first and also fullest observations are those made by Dr. Gould and his staff at Cordova.

His results but not the detailed observations are given in the Uranometria Argentina.

In 1883 Prof. Winslow Upton of Brown University, Providence, U.S.A., while in the Pacific on an eclipse expedition made observations of variable stars south of −30° Dec. Unfortunately I have not these observations to refer to.

Since 1883 no *regular* observations of variables have been made, if we except the valuable and continued examination of the light curve of R. Carinae made at Windsor, N.S.W., by Mr. Tebbutt. It was this lack of information that induced me in May last year to take up the subject. The instrument used in most of the determinations at Lovedale has been an ordinary opera glass and the

method a modification of that of Argelander. I hope ere long to obtain a wedge photometer with which, if health and leisure permit me, I hope to determine the magnitudes of all stars brighter than the 8th mag. south of — 30° Dec.

(1) R Sculptoris

R.A. $1^h \cdot 25^m \cdot 55^s$

Dec. — 33° · 6·′8

A variable discovered at Cordova in 1872. Its period as obtained from comparing the minimum of December, 1891, with that of November 15, 1878, is about 207·5 days. Dr. Gould found a period of 207 days. Its red colour is very intense all through its light changes, which are very regular. The minimum of December 1891 was not well marked, indeed it remained at 8·0 mag. all through December and January. It is now increasing in brightness and a maximum may be expected about the end of this month (March, 1892) when it will be quite visible to the naked eye.

(2) R Reticuli

R.A. $4^h \cdot 32^m \cdot 13^s$

Dec. — 63° · 18·′0

This star was discovered in 1867 by a Hindu observer at the Madras Observatory. Its variation, however, was left unconfirmed. On August 27, 1891, it was 7·2 and on August 28, 7·0 mag. It then began to decrease in brightness, being invisible in the opera glass by the end of October. The period assigned to it by its discoverer is nine months, so that a maximum may be expected in June, 1892.

(3) S Reticuli (L. 1551)

R.A. $4^h \cdot 32^m \cdot 22^s$

Dec. — 63°··3·′0

The variation of this star was suspected in June. In May, 1891 it was fainter than L. 1523 or 6·3 ; in June it was brighter or 6·0. On December 4, 1891, it was noted equal to η Reticuli or 5·8. It is now again fainter than L. 1523 or 6·3 mag. There can therefore be little doubt as to its variation.

(4) R Doradus (L. 1567)

R.A. $4^h \cdot 35^m \cdot 30^s$

Dec. — 62° · 17·′6

A variable star discovered at Cordova where its limits were noted 5·6 mag. and 6·5 mag.

This star was carefully watched throughout 1891. During the winter months it was uniformly 6·6 mag. On December 6 it was noted 6·1; December 19, 5·9; December 23, 5·8; and December 25, 5·7. Since then its magnitude has not altered much, although there seems indications of a slight decrease. Its colour is red, and it easily seen by the naked eye at a maximum.

This star has decreased now (March 25, 1892) about 0·4 magnitude, being fainter than L. 1523 or 6·2 mag. It is equal to L. 1551.

(5) S Doradus (L. 1629)

R.A. $4^h \cdot 43^m \cdot 57^s$

Dec. — $63° \cdot 25' \cdot 8$

My attention was called to this star by Mr. Finlay. It is usually equal to L. 1582 or 7·0 mag. but on December 30, 1891, it was equal to L. 1496 or 6·6. Since then it has decreased slightly being now 6·[illegible]. We have probably here a region of great activity.

(6) L_2 Puppis (L. 2691)

R.A. $7^h \cdot 10^m \cdot 10^s$

Dec. — $44° \cdot 27' \cdot 7$

A variable discovered at Cordova in 1871. Careful examination of its light curve was made at Cordova from 1871 to 1878 resulting in a period of 135 days. Mr. Stanley Williams finds a period of 136·05 days. Systematic observations were made here from April, 1891, to the present date. A strongly marked maximum was observed on February 28, mag. 3·3. Comparing this maximum with one observed by Dr. Gould on February 8th, 1874, we obtain a period of 136·9 days. Its variation at a maximum is extremely rapid.

(7) π Puppis (L. 2720)

R.A. $7^h \cdot 13^m \cdot 16^s$

Dec. — $36° \cdot 54' \cdot 1$

No such variation as that recorded by Dr. Gould has been noticed here. There are reasons, however, for believing it to have changed in colour.

Mr. Stanley Williams confirms the variation of nearly 1 mag. found by Dr. Gould.

(8) R Puppis (L. 2916)

R.A. $7^h \cdot 36^m \cdot 36^s$

Dec. — $31° \cdot 24' \cdot 3$

A star which was noticed to vary between the limits 6·5 and 7·4

at Cordova. At Lovedale during all the observations of it (considerably over fifty) it was uniformly of the 8th mag.

(9) S Puppis (L. 2999)

R.A. $7^h \cdot 43^m \cdot 32^s$

Dec. — 47°·50·′8

Lacaille noted this star 6th mag. and in Proctor's Atlas it is accordingly entered as a 6th mag. star. At Cordova it was recorded as variable between the limits 9·0 and 7·3. It has not varied here during 1891, its usual value being 8·2 mag.

(10) T Puppis (L. 3001)

R.A. $7^h \cdot 44^m \cdot 22^s$

Dec. — 40°·22·′8

This star was also discovered at Cordova, the assigned limits being 6·5 and 7·2. It has varied slightly during 1891, decreasing about $\frac{2}{10}$ the of a mag. It is now 7·2 mag.

(11) Puppis

R.A. $7^h \cdot 49^m \cdot 55^s$

Dec. — 40°·30′

This star—a 7th mag. one—is not contained in Stone's Catalogue. Mr. Finlay informs me it is not in Gould's Zones. It must therefore be a new variable. Since its discovery in December it has slightly decreased in magnitude.

(12) Puppis (L. 3105)

R.A. $7^h \cdot 55^m \cdot 5^s$

Dec. — 48°.56·′7

This variable was discovered by Stanley Williams who assigned to it a period of $4\frac{1}{2}$ days. I find its maximum limits to be much higher than those found by Williams. Mr. Williams found it alternately greater and less than L. 3069. It has never been observed here less, and there are very good grounds for supposing that L. 3069 itself is variable. I have not been able to confirm Mr. Williams's period yet.

(13) R Pyxidis.

R.A. $8^h \cdot 47^m \cdot 35^s$

Dec. — 36°·4·′5

The variation of this star was not definitely settled at Cordova, but yet Dr. Gould says he has no doubt as to its variation. The limits he assigns to it are 6·5 and 7·5. The very few measures taken here show no variation.

(14) N Velorum (L. 3910)

R.A. $8^h \cdot 27^m \cdot 54^s$

Dec. — $56° \cdot 32' \cdot 9$

There has always been a doubt as to the variation of this star. Dr. Gould assigns to it a period of $4\frac{1}{2}$ days, with limits 3·5 and 4·5. The star has been carefully watched through the year, and if we except one or two very doubtful estimates no variation such as that recorded at Cordova has been noticed.

(15) Carinæ (L. 3393

R.A. $8^h \cdot 26^m \cdot 30^s$

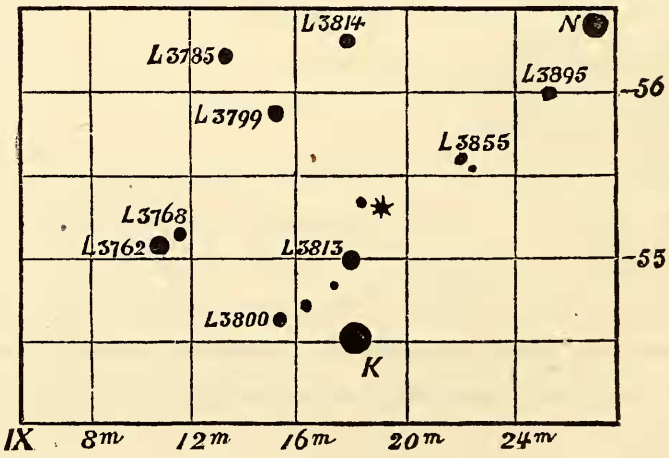
Dec. — $59° \cdot 45' \cdot 5$

A short period variable discovered in February, 1892. It is marked 7·0 mag. in Stone's Catalogue and Lacaille observed it as about the same magnitude. It varies through half a magnitude in a period of seven days, its maximum being 7·0 and minimum 7·5. It has a 7·8 mag. star very near it which is favourable for comparison. The constellation Carina and especially this portion just on the fringe of the milky way seems rich in variables.

(15A) New Short Period Variable

Approx. R.A. $9^h \cdot 19^m$

Approx. Dec. — $55° \cdot 3'$



Period = 15 days.

Max. = 7·2 mag.

Min. = below 8·0 mag.

Rise to maximum more rapid than descent to minimum. A well-marked maximum took place on 8th March, and a minimum on 19th March. It is not included in the Cape Catalogue for 1880.

(16) R Carinæ (L. 3932)

R.A. $9^h \cdot 29^m \cdot 29^s$

Dec. $-62° \cdot 18' \cdot 1$

The most remarkable variable in the Southern Heavens. It was discovered at Cordova and during the years 1872–1878 careful measures were made. Since then Mr. Tebbutt of Windsor, N.S.W., has made the variation of this star a special study. A maximum occurred in January, 1892, but it was not well marked. It is now (March 17) slightly less than the 7th mag. At a minimum it is only visible in a fairly good telescope. A period of 310·8 days was obtained by comparing some measures made by Mr. Ellery, Melbourne, in 1867, and measures made at Lovedale in 1891. Between these years there were 29 periods. The periods are not at all similar, and the light curve especially at a maximum varies each period.

(17) *l* Carinæ (L. 4033)

R.A. $9^h \cdot 42^m \cdot 14^s$

Dec. $-62° \cdot 0' \cdot 1$

Over one hundred observations were taken of this star during 1891 alone. It was first discovered at Cordova by Dr. Gould who assigned to it a period of thirty-one days and limits 3·7 and 4·2 mag.

An examination of the observations here shewed that the period was not thirty-one days but 36·5 days, and a further examination of the data supplied by Dr. Gould in the Uranometria Argentina shewed that the period of thirty-one days was not favoured by the Cordova measures, but that a period of thirty-six or thirty-seven days would be more satisfactory. The light curve is an extremely interesting one.

(18) R Velorum

R.A. $10^h \cdot 2^m \cdot 1^s$

Dec. $-51° \cdot 39' \cdot 2$

This star was discovered at Cordova but the variation was not satisfactorily determined. Not many measures were taken here, only about twenty, and so no definite opinion can be offered.

(19) R Antliæ

R.A. $10^h \cdot 5^m \cdot 1^s$

Dec. $-37° \cdot 11' \cdot 4$

A variable discovered at Cordova; limits $6\frac{1}{2}$ to 8·0; and period undetermined. It is probably a long period variable. No variation has been observed here during 1891, its normal magnitude being 8·0.

(20) Carinæ (L. 4179)

R.A. $10^h \cdot 4^m \cdot 30^s$

Dec. $-61° \cdot 41' \cdot 0$

This star was constantly used as a comparison star for S Carinæ. Its usual magnitude is 6·9, equal to L. 4224. In February its magnitude suddenly increased half a magnitude, and it is now between L. 4153 and L. 4066 or 6·4 mag. The star has been so constantly used that there can be little doubt as to its variation.

(21) S Carinæ (L. 4189)

R.A. $10^h \cdot 5^m \cdot 52^s$

Dec. $-61° \cdot 0' \cdot 6$

A variable discovered at Cordova. At a maximum it becomes visible to the naked eye and at a minimum it is between the 9th and 10th mag. In Mr. Gore's catalogue the periodic time is entered as seven months. This is an error. A careful examination of all the measures taken here, nearly one hundred, gives a period of 145 days. A maximum took place on June 27th, 1891. The star is quickly increasing in magnitude and a maximum may be expected in April.

(21A) *q* Carinæ

R.A. $10^h \cdot 12^m \cdot 55^s$

Dec. $-60 \cdot 42' \cdot 5$

This star was suspected of variation by Dr. Gould. In May, 1891, it was greater than *p* Carinæ or 3·4 mag. It is now decidedly fainter, being almost equal to *α* Carinæ or 3·7 mag.

(22) *η* Argus (L. 4457)

R.A. $10^h \cdot 40^m \cdot 47^s$

Dec. $-59° \cdot 6' \cdot 3$

This famous variable has not varied during 1891. Its magnitude now is 7·0 or 6·9. It can be seen with the naked eye but no doubt this is because of the combined brilliance of the nebula and star.

(23) T Carinæ (L. 4530)

R.A. $10^h \cdot 50^m \cdot 53^s$

Dec. $-59° \cdot 56' \cdot 0$

The variation of this star was suspected at Cordova but the limits of its variation—four-tenths of a magnitude—are so small that it ought not to be included among the better known variables. Several

stars in the neighbourhood of this star are certainly variable, L. 4556 is variable but within small limits, and so is L. 4542, a new variable described below.

(24) U Carinæ (L. 4542)

R.A. $10^h \cdot 53^m \cdot 16^s$

Dec. — $59° \cdot 8' \cdot 3$

The variation of this star was discovered in May, 1891. Its limits are 6·8 and 8·0 and its period thirty-nine days. Its light curve is extremely interesting, the ascent from minimum to maximum taking only eight or nine days. It has just (March 17) passed a maximum. At a maximum it is visible to the naked eye.

(25) S Muscæ (L. 5060)

R.A. $12^h \cdot 6^m \cdot 50^s$

Dec. — $62° \cdot 32' \cdot 5$

The variation of this star was discovered in June, 1891. Its limits are 6·5 and 7·2, and its period 9·6 days. Its light curve is very regular, the period from maximum to minimum being one day longer than from minimum to maximum. It is six days visible to the naked eye and three days invisible.

(26) R Crucis (S. 6883)

R.A. $12^h \cdot 17^m \cdot 34^s$

Dec. —$61° \cdot 0' \cdot 7$

The variation of this short period variable was discovered in August, 1891. Its limits are 6·8 and 8·0 and its period 5·8 days. As in almost all the other short period variables its period from maximum to minimum is slightly longer than the period from minimum to maximum.

(27) R Muscæ (L. 5236)

R.A. $12^h \cdot 35^m \cdot 23^s$

Dec. — $68° \cdot 48' \cdot 2$

This was the first variable discovered by Dr. Gould. It is remarkable for the shortness of its period, only twenty-one hours. Its limits also—6·8 and 7·6—result in its being visible for nine hours and invisible for twelve hours. A comparison of the measures in the Uranometria Argentina with those made at Lovedale result in a period of ·88885 days.

(28) S Crucis (L. 5314)

R.A. $12^h \cdot 47^m \cdot 51^s$

Dec. — $57^\circ \cdot 49' \cdot 5$

The variation of this star was discovered in August, 1891. Its limits are 6·8 and 7·5 and its period 4·84 days. Frequently at maximum it has been seen with the naked eye. Especially is this the case with the maximum of March 17, 8 p.m.

(29) R Centauri

R.A. $14^h \cdot 8^m \cdot 39^s$

Dec. — $59^\circ \cdot 24' \cdot 0$

The variation of this star was discovered at Cordova. Its light-changes are extremely perplexing and as yet defy a good period. In August 1891 it was a little brighter than the 7th mag. but after that it steadily decreased, becoming by October, 1891, invisible in the opera glass.

(30) Apodis (L. 6077)

R.A. $14^h \cdot 45^m \cdot 15^s$

Dec. — $76^\circ \cdot 12' \cdot 7$

A variable discovered at Cordova. The limits being 5·5 and 6·2 mag. No period has been determined. The observations here do not indicate any variation, but they have not been sufficiently numerous to warrant any definite statement as to the star's variation.

(31) T Trianguli (L. 6193)

R.A. $14^h \cdot 59^m \cdot 29^s$

Dec. — $68^\circ \cdot 17' \cdot 7$

A star suspected of variation at Cordova but with limits 7·0 and 7·4. No star has been more frequently examined at Lovedale than this, but because of the change of light in some of the comparison stars, the slight changes in the star itself and its period almost synchronous with a solar day, no definite period was obtained. What has been said about T Carinæ holds good here. Stars that vary through smaller limits than half a magnitude should not be considered variable.

(32) R Trianguli (L. 6264)

R.A. $15^h \cdot 9^m \cdot 56^s$

Dec. — $66^\circ \cdot 5' \cdot 5$

A variable discovered at Cordova; limits 6·6 and 7·5. A com-

parison of measures made at Lovedale in 1891 and at Cordova in 1871 result in a period of $3^d \cdot 9^h \cdot 33^m \cdot 59^s \cdot 04 \pm 0^s \cdot 50$.

(33)—Lupi.

R.A. $15^h \cdot 46^m \cdot 20^s$
Dec. $- 35^\circ \cdot 58' \cdot 0$

A variable discovered during the zone examinations at Cordova, limits 9·0 and 12·0. Period undetermined. No measures were made at Lovedale.

(34) R Aræ (L. 6887)

R.A. $16^h \cdot 30^m \cdot 17^s$
Dec. $- 56^\circ \cdot 46' \cdot 2$

A star certainly variable, discovered in September, 1891. Period and light curve undetermined. On September 9, October 10, 1891, and on February 24 the star was below 7·5, at other times it was uniformly above 7·0 mag. Unfortunately no observations were made later than 12 p.m., so that the search for its law of variation is in a manner restricted.

(35) κ Pavonis (L. 7856)

R.A. $18^h \cdot 45^m \cdot 37^s$
Dec. $- 67^\circ \cdot 22' \cdot 3$

A variable discovered at Cordova, limits 4·0 and 5·5 and period 9·1 days.

Its light curve is extremely regular and very interesting. Comparisons between the measures made at Lovedale in 1891 and those made at Cordova in 1873 give a period of 9·090 days. If we suppose one period less—719—to have taken place in the interval the period is 9·103 days. The former value agrees better with measures made here.

The elements of κ Pavonis are :

Maximum 1891, July $6 \cdot 35 \pm \cdot 14 + 9 \cdot 090\, t$.
Minimum 1891, July $10 \cdot 96 \pm \cdot 25 + 9 \cdot 090\, t$.

(36) S Coronæ Australis.

R.A. $18^h \cdot 53^m \cdot 43^s$
Dec. $- 37^\circ \cdot 6' \cdot 5$

A variable discovered by Schmidt in 1866, limits 10 mag. and $11\frac{1}{2}$ mag. No measures made at Lovedale. Period obtained by Schmidt, 6·2 days.

(37) R Coronæ Australis.

R.A. $18^h \cdot 54^m \cdot 28^s$

Dec. $-37^\circ \cdot 6' \cdot 4$

A variable discovered by Schmidt in 1866, limits $10\frac{1}{2}$ and $12\frac{1}{2}$. Period obtained, 31 days, but this considered doubtful. No observations at Lovedale.

(38) R Piscis Australis

R.A. $22^h \cdot 11^m \cdot 54^s$

Dec. $-30^\circ \cdot 9' \cdot 2$

A star found variable during the zone observations at Cordova: limits $8\frac{1}{2}$ and 11 mag. No observations made at Lovedale.

(39) R Indi

R.A. $22^h \cdot 28^m \cdot 8^s$

Dec. $-67^\circ \cdot 51 \cdot 3$

A star found variable during the zone observations at Cordova: limits $8\frac{1}{2}$ and below 11 mag. No observations at Lovedale.

(40) Phœnicis

R.A. $23^h \cdot 50^m \cdot 44^s$

Dec. $-50^\circ \cdot 24' \cdot 0$

A star found variable during the zone observations at Cordova: limits $8\frac{1}{2}$ and below 11. No observations at Lovedale.